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The Agricultural Production Impact on the Algerian Economic Diversification: An Econometric Study During the Period (2000-2020)

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Abstract: From this study, we tried to analyze the impact of agricultural production in Algeria on the exports diversification during the period 2000-2020, by studying its impact on the export diversification indices, by analyzing their time series and estimating the relationship between them using the VECM model.

Therefore, we have concluded that there is not a significant impact of the agricultural production on the indicators of the economic diversification, which confirms the need to activate its role as a support of sustainable economic growth, and one of the most important sources of economic diversification.

Keywords: Agricultural Sector; Economic Diversification; Exports Diversification; VECM models.

1. Introduction

The Algerian economy has witnessed a profound transformation that changed its economic activity course from a socialist doctrine towards a market economy. However, the reality does not express a real change leading to the liberalization of the economy from an almost absolute dependency on the hydrocarbons sector, which gives to the economic diversification a serious role and an inevitable reality.

Thus, the economic diversification has found an increasing interest aimed to liberate the national economy from its dependency to the hydrocarbon sector and protecting it from economic vulnerability, because of this dependency, that threatens its economic sectors from the risk of deindustrialization (Y.Benabdallah, 2007).

Therefore, this emphasize the necessity to create a new alternatives of the hydrocarbon sector by diversifying its economy, especially, during the pandemic crisis (COVID-19) that stormed the world at the end of the year 2019 and expanded rapidly among the world's population (Ababsa, M., & Aouissi, H. A, 2020), with its impact on economic activity causing a collapse in fuel prices.

In this situation, the Algerian's economy has witnessed a real dependence to the hydrocarbons exports prices. It made it more exposed to the risks of the foreign trade - as a result of its fluctuations-, which can summarize the symptoms of the Dutch disease (ع.بن قدور، س. كردودي,2017). Consequently, it affects the production structure, and a decline in the profitability of strategic sectors such as industry and agriculture, and this limits the possibility of diversifying the economy (Corden, W. M, & Neary, J. P. 1982).

1.1. Study Problematic

Does agricultural production have an impact on economic diversification index in Algeria?

1.2. Study Hypothesis

Agricultural production affects the economic diversification index in the short and long term including the following indicators: Absolut Value, products diversification export index and the Products Concentration export index.

1.3. Study Importance and Aims

This study takes its importance from the crucial importance of the agricultural sector as a generator of the sustainable economic growth, and a source of the industrial raw material, as well as an important factor supporting the diversification.

Thereby, we aim from this study to extract the econometric effect of agricultural production on the economic diversification index in Algeria, during the period 2000-2020 using a VAR model of the time series for each indicator, and to propose suggestions that could enhance the role of agricultural activity in diversifying the economy and liberating it from the hydrocarbon sector.

1.4. Material and methods

To analyze the presented problematic, we used an econometric approach to estimate the relationship between the indices shown as time series, and extracting the impact of the agricultural production index on the exports diversification index. Therefore, we collected the required data from the national and international documents and websites such as the World Bank, the ONS, the FAO.

1.5. The parts of the study

This paper is divided into three sections: the first part includes basic concepts about economic diversification; the second section includes an analysis of the reality of agricultural production in Algeria during the period of study. The final part is devoted to estimate the econometric model of the agricultural production effect on the economic diversification index. This estimation should be done using the aforementioned indicators, with a conclusion and recommendations

2. Basic concepts of economic diversification

2.1. Definitions

Economic diversification can be considered as an operation of an increasing groups that shares the composition of the aggregate product, or means diversifying the sources of the gross domestic product. It can also be known as diversifying the income resources in the general budget of the state, or diversifying markets such as internal markets or export markets (2014 ع. لافي مرزوك، ع. مكي حمزة).

Therefore, the economic diversification allows the economic activity to exit from the situation that Watkins 1963 called -in the case of Canada- "the trap of basic primary

products" (2016 ،ك. رواينية، م. باهي), by building a base, a wide range of local exportable products and protect the country from economic fluctuations.

It is also known as "creating additional non-hydrocarbon sources of foreign currency and general budget revenues, with creating sustainable sources for use in the productive service sectors to absorb the growing active class entering the labor market, away from government use" ،2016 ح. عبد الحسين الجبوري).

So generally, an economic diversification is to reduce dependence on an only resource and move towards supporting the industrial and agricultural base of the country's economy and creating a solid base of production, which means building a healthy and coherent national economy that moves towards self-sufficiency in more than one sector.

2.2. Forms of economic diversification

The economic diversification has different aspects and forms that can include (م. باهي 2016 ،ك. رواينية): a diversification of the industrial productive structure, which aims to enter into new spaces of production, and diversification of the markets, which aims to create external economies and reach new markets with new products.

2.3. The exports diversification indices

There are many economic diversification index used to measure the economic diversification we can mention especially the indexes used in our study:

2.3.1. The absolute value

Which means the number of products exported at the level of the group of the standard classification for international trade exported by each country, (unctadstat, 2021).

2.3.2. The product diversification indices of exports

The diversification index is measure between 0 and 1 computed by measuring the absolute deviation of the trade structure of a country from world structure, which is a modified Finger-Kreinin measure of similarity in trade (unctadstat, 2021).

2.3.3. The product concentration indices of exports

This index, which is between 0 and 1, for each country, measures the degree of concentration of export products without services. It tells us whether a large share of a country's exports come from a limited number of products or whether, on the contrary, they are distributed more evenly among a larger number of products (unctadstat ,2021).

3. Estimation of the relationship between the series

In order to estimation of the relationship between agricultural production index and the diversification indicators: absolute value, concentration index and diversification index, we use the vectorial stochastic relationship between them such as: VAR, VECM, ARDL, according to the ADF test of our series.

Therefore, in order to analyze the impact of the agricultural production index on the indicators of export diversification, we will adopt the time series analysis to determine the relationship between the indicators that were downloaded from the two sites: the FAO and UNCTAD, which concern: agricultural production index, absolute value, and the product diversification and concentration indices of exports.

The VECM model was used to analyze the time series, as the series are integrated of order 1; also from the Johnsson's test, we found the possibility of a long-term relationship between the study variables, which require to estimate the long-term correction factor of the deviation according to the VECM model (Bourbonnais, R. 2015, p 308)

After fulfill the Cointegration Rank Test (Trace) and maximum eigenvalue test, we can

find the number of cointigration relationships (Greene, W. H. 2012), and thus, we can estimate the relationship between the indices for our study.

3.1. Unit test roots of the series

To verify the stationarity of our series we have to use the ADF testes, which allows us to determine the type of series in case of nonstationary and its order (Greene, W. 2012, p982).

Table .1. ADF test of the series

Series	ADF test at level			ADF test with the first difference			Status
	With trend and intercept	With intercept only	Without trend and intercept	With trend and intercept	With intercept only	Without trend and intercept	
	Prob			Prob			
PRODUCTION	/	/	0.9140	/	/	0.0006	I(1)
VABSOLUE	/	/	0.7573	/	/	0.0000	I(1)
DIVERSIFICATION	/	/	0.6060	/	/	0.0000	I(1)
CONCENTRATION	/	/	0.5230	/	/	0.0000	I(1)

Source: from database using Eviews 10

The ADF test results of production index, Absolut Value, Diversification export index and Products Concentration export index, without a trend or intercept for all series cases is displayed in the table 1 where we found:

First, the production index series is integrated of order1. It could be stationary by taking the first difference of the series.

As the same way, we found that the series of the Absolut value is nonstationary; therefore, the first difference produces a stationary series, so the original series it integrated of order 1.

In addition, the products diversification export index is nonstationary; and the first difference produces a stationary series, so the original series it integrated of order 1

Finally, from the Augmented Dickey-Fuller test, the Products Concentration export index is nonstationary; and the first difference gives a stationary series, so the original series it integrated of order 1.

3.2. Estmation of the econometric model

3.2.1. The Cointegration tests

The VECM is a model used to analyze the time series integrated of order 1 (I(1)); therefore, from the test of Johnsson, we found the possibility of a long-term relationship between the study variables, which require to estimate the long-term correction factor of the deviation according to the VECM model (Bourbonnais, R. 2015, p 308).

The Johansen test is a statistical method used in econometrics to test for cointegration among multiple time series variables. It relies on two test statistics: the trace statistic and the maximum eigenvalue statistic.

Table .2. determination of level of delay

VAR Lag Order Selection Criteria
Endogenous variables: PRODUCTION VABSOLUE CONCENTRATION DIVERSIFICATION
Exogenous variables: C
Date: 02/25/21 Time: 00:48
Sample: 1995 2018
Included observations: 22

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-84.22617	NA	0.035768	8.020561	8.218932	8.067291
1	-34.46750	76.89977*	0.001716*	4.951591*	5.943447*	5.185242*
2	-25.08249	11.09138	0.003716	5.552953	7.338295	5.973526

Source: from database using Eviews 10

Table .3. Cointegration Rank Test (Trace)

Date: 02/25/21 Time: 00:25
Sample (adjusted): 1999 2018
Included observations: 20 after adjustments
Trend assumption: No deterministic trend
Series: PRODUCTION VABSOLUE CONCENTRATION DIVERSIFICATION
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.983915	147.0006	40.17493	0.0000
At most 1 *	0.932194	64.40265	24.27596	0.0000
At most 2	0.396064	10.58049	12.32090	0.0962
At most 3	0.024434	0.494747	4.129906	0.5449

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: from database using Eviews 10

Table .4. Cointegration Rank Test (Maximum Eigenvalue)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.983915	82.59796	24.15921	0.0000
At most 1 *	0.932194	53.82216	17.79730	0.0000
At most 2	0.396064	10.08574	11.22480	0.0788
At most 3	0.024434	0.494747	4.129906	0.5449

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: from database using Eviews 10

After fulfill the trace test in the table. 03, and maximum eigenvalue test in the table. 04, the number of cointigration relationships after determination of the level of delay 1 as shown in the table (02), we find 2 relations, and accordingly, we can estimate the relationship model of the indices for our study

3.2.2. The VECM model for the absolute value index

In order to estimate the relationship between the absolute value index and agricultural production in the short term a VECM is estimated where we found the following results:

Table .5. The VECM model of the absolute value index

Dependent Variable: D(VABSOLUE)

Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/25/21 Time: 10:43
Sample (adjusted): 1997 2018
Included observations: 22 after adjustments
D(VABSOLUE) = C(7)*(PRODUCTION(-1) + 4181.55548269
*CONCENTRATION(-1) - 2907.88794698*DIVERSIFICATION(-1)) +
C(8)*(VABSOLUE(-1) + 1159.29539981*CONCENTRATION(-1) -
907.844104774*DIVERSIFICATION(-1)) + C(9)*D(PRODUCTION(-1)) +
C(10)*D(VABSOLUE(-1)) + C(11)*D(CONCENTRATION(-1)) + C(12)
*D(DIVERSIFICATION(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
C(7)	0.096455	0.081139	1.188765	0.2519
C(8)	-0.359916	0.273572	-1.315620	0.2068
C(9)	-0.156774	0.270160	-0.580301	0.5698
C(10)	-0.117357	0.268745	-0.436685	0.6682
C(11)	168.8331	73.32937	2.302394	0.0351
C(12)	-72.73624	81.19210	-0.895854	0.3836

R-squared	0.428545	Mean dependent var	1.090909
Adjusted R-squared	0.249965	S.D. dependent var	10.10379
S.E. of regression	8.750342	Akaike info criterion	7.403063
Sum squared resid	1225.096	Schwarz criterion	7.700620
Log likelihood	-75.43370	Hannan-Quinn criter.	7.473159
Durbin-Watson stat	1.816317		

Source: from database using Eviews 10

From the table. 05, which is representing the estimation output we find only the coefficient c(11) representing the concentration which has a significant positive effect on the absolute value index, this can reflect an absence of the effect of agricultural production on export diversification.

3.2.3. The VECM model for the Products concentration index

In the same way, in order to estimate the relationship between the products concentration index and agricultural production in the short term a VECM is estimated where we found the following results:

Table .6. The VECM model results of the product concentration index

Dependent Variable: D(CONCENTRATION)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/25/21 Time: 10:44
Sample (adjusted): 1997 2018
Included observations: 22 after adjustments
D(CONCENTRATION) = C(13)*(PRODUCTION(-1) + 4181.55548269
*CONCENTRATION(-1) - 2907.88794698*DIVERSIFICATION(-1)) +
C(14)*(VABSOLUE(-1) + 1159.29539981*CONCENTRATION(-1) -
907.844104774*DIVERSIFICATION(-1)) + C(15)*D(PRODUCTION(-1))
+ C(16)*D(VABSOLUE(-1)) + C(17)*D(CONCENTRATION(-1)) + C(18)
*D(DIVERSIFICATION(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
C(13)	-0.000129	0.000191	-0.675032	0.5093
C(14)	0.000213	0.000644	0.330209	0.7455
C(15)	0.000221	0.000636	0.348214	0.7322
C(16)	-1.06E-05	0.000633	-0.016740	0.9869
C(17)	0.072626	0.172642	0.420673	0.6796

C(18)	-0.319163	0.191153	-1.669669	0.1144
R-squared	0.409249	Mean dependent var		0.001093
Adjusted R-squared	0.224639	S.D. dependent var		0.023396
S.E. of regression	0.020601	Akaike info criterion		-4.699931
Sum squared resid	0.006791	Schwarz criterion		-4.402374
Log likelihood	57.69924	Hannan-Quinn criter.		-4.629835
Durbin-Watson stat	1.598625			

Source: from database using Eviews 10

From the table. 06 that represents the estimation output, we don't find any significant coefficient of the effect of agricultural product on the products concentration index whether in the short or the long run, this can reflect also an absence of the effect of agricultural production on export diversification

3.2.4. The VECM model for the Products diversification index

Finally, for the products diversification to estimate the relationship between this series and agricultural production in the short term a VECM is estimated where we found the following results:

Table .7. The VECM model of the product diversification index

Dependent Variable: D(DIVERSIFICATION)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/25/21 Time: 10:45
Sample (adjusted): 1997 2018
Included observations: 22 after adjustments
D(DIVERSIFICATION) = C(19)*(PRODUCTION(-1) + 4181.55548269 *CONCENTRATION(-1) - 2907.88794698*DIVERSIFICATION(-1)) + C(20)*(VABSOLUE(-1) + 1159.29539981*CONCENTRATION(-1) - 907.844104774*DIVERSIFICATION(-1)) + C(21)*D(PRODUCTION(-1)) + C(22)*D(VABSOLUE(-1)) + C(23)*D(CONCENTRATION(-1)) + C(24) *D(DIVERSIFICATION(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
C(19)	0.000212	0.000244	0.867586	0.3984
C(20)	-0.000761	0.000824	-0.924244	0.3691
C(21)	-0.000501	0.000813	-0.615619	0.5468
C(22)	-0.000993	0.000809	-1.227109	0.2375
C(23)	0.086986	0.220777	0.393998	0.6988
C(24)	-0.303082	0.244450	-1.239850	0.2329
R-squared	0.368283	Mean dependent var		0.000200
Adjusted R-squared	0.170871	S.D. dependent var		0.028933
S.E. of regression	0.026345	Akaike info criterion		-4.208059
Sum squared resid	0.011105	Schwarz criterion		-3.910502
Log likelihood	52.28865	Hannan-Quinn criter.		-4.137964
Durbin-Watson stat	1.896016			

Source: from database using Eviews 10

In the last table. 07, it is representing the estimation output, we don't find any significant coefficient of the effect of agricultural product on the products diversification index whether in the short or the long run, this can reflect an additional absence of the effect of agricultural production on export diversification.

4. Conclusion

At the end, in this paper we tried to analyze the effect of the agricultural production in

Algeria on the diversification indices, which include the absolute value, the products concentration index, products diversification index. Moreover, we used an econometric approach to estimate the relationship between the indices using a VECM model according to the ADF results of our series, where we found them integrated of order1.

From the econometric estimation of the VECM models, we found that the agricultural production index doesn't have a significant effect on the diversification indices.

This result reflect the weak performance of the agricultural sector towards the economic diversification (2018 ,لهبيبات، أ ,عبابسه، م). This poor effectiveness can be the result of inappropriate climate of investment, which has to be supported especially for the vulnerable situation of the Algerian economy towards foreign trade risks (Y.Benabdallah, 2007).

After all, an economic diversification can be achieved by implementing various strategies, which include:

-Investment in Infrastructure such as transportation networks, energy systems, communication technologies, and utilities can facilitate the growth of diverse economic activities and attract investments, enhances productivity, and supports the emergence of new industries.

-Education and Skill Development in order to prepare the workforce for employment in a wide range of sectors

-Promotion of Entrepreneurship and Innovation

-Development of Special Economic Zones with favorable tax policies, regulatory frameworks, and infrastructure can attract investment and facilitate the growth of industries.

-Promotion of Economic Clusters to stimulate innovation, knowledge sharing, and economies of scale. Clusters bring together related industries, suppliers, service providers, and research institutions, creating synergies and fostering competitiveness.

-Support for Small and Medium Enterprises, which often operate in diverse sectors, can contribute to economic diversification. This includes access to finance, business development services, technical assistance, and capacity-building initiatives.

-Regional Development Policies can reduce regional disparities and encourage the growth of diverse economic activities across different geographical areas.

Economic diversification is a complex and long-term process that requires coordinated efforts from governments, businesses, and other stakeholders. It involves addressing structural barriers, fostering innovation and entrepreneurship, and creating an enabling environment for economic growth across multiple sectors.

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Appendix

ADF test of the series: production index

Null Hypothesis: PRODUCTION has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.022901	0.9140
Test critical values:	1% level	-2.669359	
	5% level	-1.956406	
	10% level	-1.608495	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(PRODUCTION)
Method: Least Squares
Date: 02/22/21 Time: 16:06
Sample (adjusted): 1996 2018
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

PRODUCTION(-1)	0.021738	0.021251	1.022901	0.3175

Source: from database using Eviews 10

ADF test of the series: production index after the first difference

Null Hypothesis: D(PRODUCTION) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.820709	0.0006
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

Source: from database using Eviews 10

ADF test of the series: Absolut value

Null Hypothesis: VABSOLUE has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.276139	0.7573
Test critical values:	1% level	-2.669359	
	5% level	-1.956406	
	10% level	-1.608495	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(VABSOLUE)
Method: Least Squares
Date: 02/22/21 Time: 17:08
Sample (adjusted): 1996 2018
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VABSOLUE(-1)	0.005633	0.020400	0.276139	0.7850

Source: from database using Eviews 10

ADF test of the series: Absolut value after the first difference

Null Hypothesis: D(VABSOLUE) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.985232	0.0000
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

Source: from database using Eviews 10

ADF test of the series Products Diversification export index

Null Hypothesis: DIVERSIFICATION has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.192253	0.6060
Test critical values:	1% level	-2.669359	
	5% level	-1.956406	
	10% level	-1.608495	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DIVERSIFICATION)
Method: Least Squares
Date: 02/22/21 Time: 17:02
Sample (adjusted): 1996 2018
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIVERSIFICATION(-1)	-0.001433	0.007455	-0.192253	0.8493

Source: from database using Eviews 10

ADF test of the series: products diversification export index after the first difference

Null Hypothesis: D(DIVERSIFICATION) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.054298	0.0000
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

Source: from database using Eviews 10

ADF test of the series: Products Concentration export index

Null Hypothesis: CONCENTRATION has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.413613	0.5230
Test critical values:	1% level	-2.669359	
	5% level	-1.956406	
	10% level	-1.608495	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CONCENTRATION)
Method: Least Squares
Date: 02/22/21 Time: 17:09
Sample (adjusted): 1996 2018
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONCENTRATION(-1)	-0.004311	0.010422	-0.413613	0.6832

Source: from database using Eviews 10

ADF test of the series: Products Concentration export index after the first difference

Null Hypothesis: D(CONCENTRATION) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.687294	0.0000
Test critical values:	1% level	-2.674290	
	5% level	-1.957204	
	10% level	-1.608175	

Source: from database using Eviews 10

Abbreviations

abbreviations	**Full notion**
VECM	Vector error correction model
VAR	Vector Autoregressive models
ARDL	Autoregressive Distributed Lag model